U.S. Department
of Transportation

**Research and
Special Programs
Administration**

400 Seventh Street, S.W.
Washington, D.C. 20590

MAY 2 0 2004

DOT-E 12079
(THIRD REVISION)

EXPIRATION DATE: April 30, 2006

(FOR RENEWAL, SEE 49 CFR § 107.109)

1. GRANTEE: Asahi Seisakusho Co., Ltd.
Saitama, Japan
(U.S. Agent: Catalina Cylinders, Garden Grove, CA)

2. PURPOSE AND LIMITATIONS:

a. This exemption authorizes the manufacture, mark, sale and use of a non-DOT specification cylinder conforming in part with the DOT-3AA specification, except as specified herein, for the transportation in commerce of the materials authorized by this exemption. This exemption provides no relief from the Hazardous Materials Regulations (HMR) other than as specifically stated herein.

b. The safety analyses performed in development of this exemption only considered the hazards and risks associated with transportation in commerce. The safety analyses did not consider the hazards and risks associated with consumer use, use as a component of a transport vehicle or other device, or other uses not associated with transportation in commerce.

3. REGULATORY SYSTEM AFFECTED: 49 CFR Parts 106, 107 and 171-180.

4. REGULATIONS FROM WHICH EXEMPTED: 49 CFR § 180.205, § 173.301(a)(1), § 173.302a(a)(1) and § 173.305(a) in that a non-DOT specification cylinder is not authorized except as specified herein.

5. BASIS: This exemption is based on the application of Asahi Seisakusho Co., Ltd. dated May 4, 2004, submitted in accordance with § 107.109.

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6. HAZARDOUS MATERIALS (49 CFR § 172.101):

Proper Shipping Name/ Hazardous Material Description	Hazard Class/ Division	Identi-fication Number	Packing Group
Air, compressed	2.2	UN1002	N/A
Helium, compressed	2.2	UN1046	N/A
Oxygen, compressed	2.2	UN1072	N/A
Rare gases and oxygen mixtures, compressed	2.2	UN1980	N/A

7. SAFETY CONTROL MEASURES:

a. Packaging prescribed is a high strength, non-DOT specification steel cylinder, conforming with Asahi Seisakusho Company's drawing 12101 dated January 23, 1998, on file with the Office of Hazardous Materials Exemptions and Approvals (OHMEA), § 178.35 and DOT specification 3AA (§ 178.37), in effect on October 1, 1997, except as follows:

§ 178.35 General requirements for specification cylinders.

(a) Compliance. * * *

(1) Lot definition. In this exemption, a "lot" means a group of cylinders successively produced and having the same:

(i) Size and configuration;

(ii) Specified material of construction;

(iii) Process of manufacture and heat treatment;

(iv) Equipment of manufacture and heat treatment; and

(v) Conditions of time, temperature and atmosphere during heat treatment.

(2) In no case may the lot size exceed 200 cylinders, but any cylinder processed for use in the required destructive testing need not be counted as being one of the 200.

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(b) Inspections and analyses. * * *

(1) * * *

(2) Does not apply.

(c) Duties of inspector. * * *

(1) Inspect all material and reject any not meeting the requirements of this exemption.

(2) * * *

(3) * * *

(4) * * *

(5) Verify that the design qualification tests prescribed in § 178.37(d)(2) of this exemption have been performed with satisfactory results.

(d) Defects. * * *

(e) Safety devices. * * *

(f) Markings. * * *

(1) Each cylinder must be marked with the following information.

(i) "DOT-E 12079 3500" must replace "DOT 3AA 3500". Test pressure "TP 5250" must be marked near or following the service pressure.

(ii) * * *

(iii) * * *

(iv) * * *

(2) * * *

(3) Does not apply.

(4) * * *

(5) * * *

(6) * * *

(g) Inspector's report. * * *

(h) Report retention. * * *

§ 178.37

(a) Type, size and service pressure. In addition to the requirements of § 178.35, cylinders must conform to the following:

(1) Seamless cylinder with 7.29 inches nominal outside diameter, 0.181 inch minimum wall thickness, 50 pounds maximum water capacity, and 3,500 psig service pressure for scuba diving.

(2) Does not apply.

(b) Authorized steel. Basic oxygen furnace or equivalent steel of uniform quality is authorized. The steel analysis must conform with the following:

CHEMICAL COMPOSITION IN WEIGHT PERCENT

Element	Ladle Analyses	Check Analyses Tolerance	
		Under	Over
Carbon	0.33/0.38	0.01	0.02
Manganese	0.60/0.85	0.03	0.03
Phosphorus	0.025 max.	---	0.01
Sulfur	0.015 max.	---	0.00
Silicon	0.15/0.35	0.02	0.03
Chromium	0.90/1.20	0.03	0.03
Molybdenum	0.15/0.30	0.01	0.01
Copper	0.25 max.	---	0.00
Nickel	0.25 max.	---	0.00

Note 1: Steel must be aluminum killed and made by a fine grained deoxidation practice.

(c) Identification of material. Material must be identified by any suitable method. Steel stamping of heat identification must not be made in any area that will eventually become the sidewall of the cylinder. Depth of stamping must not encroach upon the minimum prescribed wall thickness of the cylinder.

(d) Manufacture.

(1) Cylinders must be manufactured from seamless steel tubing with both ends closed by the spinning method; no fissure or other defect is acceptable that is likely to weaken the finished cylinder appreciably. The general surface finish must not exceed a roughness of 250 r.m.s. with individual irregularities such as roll marks, scratches, pits, etc. held to a minimum. If the

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cylinder is not originally free of such defects or does not meet the finish requirements, the surface may be machined or otherwise treated to eliminate these defects. Metal removal for any purpose other than removal of isolated defects and threading must be done prior to the hydrostatic test. The thickness of the treated areas must be measured and must not be less than the minimum prescribed thickness. The cylinder end contour must be hemispherical or ellipsoidal (axis ratio of 2:1) with concave side to pressure. The thickness of the bottom center must be not less than two times the minimum wall thickness of the cylindrical shell.

(2) Design qualification testing. The design authorized herein and any significant change to this design must be qualified for production by performing the tests specified below:

(i) Burst test. Three cylinders must be hydrostatically burst without evidence of fragmentation. The rate of pressurization must not exceed 200 psi per second. Cylinders subjected to the burst test must withstand a pressure of a least 2.25 times the service pressure without failure. Failure must initiate in the sidewall in a longitudinal direction, and the cylinder must remain in one piece.

(ii) Flawed cylinder burst test. Three cylinders must be hydrostatically burst with leak before break (LBB), and leak pressure must be 1.25 times the service pressure. This test must be performed after a flaw is machined into the middle sidewall of the cylinder. The flaw must have a minimum length of six times the wall thickness. The flaws must be introduced into the cylinder by a Side Milling Cutter. The failure mode must be LBB.

(iii) Cycle test. Three cylinders must be tested to failure at an upper cyclic pressure of 1.5 times the service pressure. The successive hydrostatic pressurization from the lower cyclic pressure to the upper cyclic pressure must not exceed a rate of ten cycles per minute. Adequate recording instrumentation must be provided if equipment is to be left unattended for any period of time. Lower cyclic pressure must not exceed 10 percent of the upper cyclic pressure. Cylinders must withstand at least 10,000 cyclic pressurization without distortion or failure. The failure must occur in the sidewall and the failure mode must be leak before break (LBB).

(iv) Flawed cylinder cycle test. Three cylinders must be cycle tested to destruction at a pressure of 1.25 times the service pressure. This test must be performed after a flaw is machined into the middle sidewall of the cylinder. The flaw must have a minimum length of six times the wall thickness. The flaws must be introduced into the cylinder by a Side Milling Cutter. The failure mode must be LBB.

(v) Drop test. Three cylinders filled with water and capped properly must be dropped from a minimum height of 52 inches, two times horizontally and vertically on a steel plate. Following this test, the cylinders must satisfy the burst test requirements in §178.37(d)(2)(i) of this exemption.

(vi) Corrosion test. Three cylinders must be cycle tested to destruction to an upper cyclic pressure of 1.5 times service pressure in salt water of five weight percent minimum. The successive hydrostatic pressurization from the lower cyclic pressure to the upper cyclic pressure must not exceed a rate of ten cycles per minute. Adequate recording instrumentation must be provided if equipment is to be left unattended for any period of time. Lower cyclic pressure must not exceed 10 percent of the upper cyclic pressure. Cylinders must withstand at least 10,000 cyclic pressurization without failure.

(vii) Flattening test. Three cylinders must be flattened without cracking to eight times the wall thickness.

(3) In this exemption, "significant change" means a 10 percent or greater change in cylinder wall thickness, service pressure, or diameter; a 30 percent or greater change in water capacity or base thickness; any change in material; over 100 percent increase in size of openings; or any change in the number of openings.

(e) Welding or brazing. Welding or brazing for any purpose is prohibited except in the spinning weld process in the forming of the bottom closure of the cylinders.

(f) Wall thickness. The thickness of each cylinder must conform to the following:

(1) Does not apply.

(2) The minimum wall thickness must be such that the wall stress at the minimum specified test pressure may not exceed 67 percent of the minimum tensile strength of the steel as determined in § 178.37 (k) and (1)(4) of this exemption. A wall stress of more than 90,500 psi is not permitted and in no case may the wall thickness be less than 0.181 inch.

(3) Calculation must be made by the formula:

$$S = [P(1.3D^2+0.4d^2)]/(D^2-d^2)$$

Where:
S = wall stress in pounds per square inch;
P = minimum test pressure of 3/2 of service pressure;
D = outside diameter in inches;
d = inside diameter in inches;

(g) Heat treatment. The completed cylinders must be uniformly and properly heat treated prior to tests. Heat treatment of cylinders must be as follows:

(1) Each cylinder must be heated and held above the upper critical temperature (Ac3) for at least one hour per inch of thickness based on the maximum thickness of the cylinder and then quenched in a suitable liquid medium having a cooling rate not in excess of 80 percent of water. The steel temperature on quenching must be above the Ac3 temperature but not higher than 1700° F.

(2) After quenching, each cylinder must be reheated to a temperature below the transformation range but not less than 1000° F, and must be held at this temperature for at least one hour per inch of thickness based on the maximum thickness of the cylinder. Each cylinder must then be air cooled.

(h) Openings in cylinders and connections (valves, fuse plugs, etc.) for those openings. Threads must be clean cut, even, without checks, and to gauge. Openings are permitted in the top head and on the centerline of the cylinder only.

(1) All openings must be circular and threaded. Straight threads must be used and must conform with the following:

(i) National Gas Straight Thread (NGS) type must conform with the requirements of Federal Standard H-28 (1978), Sections 7 and 9.

(ii) United Thread (UN) type must conform with the requirements of Federal Standard H-28 (1978), Section 2.

(iii) Controlled Radius Root Thread (UNJ) type must conform with the requirements of Federal Standard H-28 (1978), Section 4.

(iv) Other straight thread types conforming with other recognized standards may be used provided that the requirements of paragraph (2) below are met.

(2) All straight threads must have at least 6 engaged threads, a tight fit, and a factor of safety in shear of at least 10 times the test pressure of the cylinder. Shear stress must be calculated by using the appropriate thread shear area in accordance with Federal Standard H-28(1978), Appendix A5, Section 3. Gaskets are required to prevent leakage.

(i) Hydrostatic test. Each cylinder must successfully withstand a hydrostatic test as follows:

(1) * * *

(2) * * *

(3) * * *

(4) Each cylinder must be tested to at least 3/2 times the service pressure.

(j) Production testing.

(1) Wet magnetic particle test. All cylinders must be tested by the wet magnetic particle method in accordance with ASTM Standard E-709-95 before closing in and after heat treatment to detect the presence of quenching cracks or other discontinuities.

(i) An ultrasonic examination may be substituted for the magnetic particle test before closing in as required in § 178.37(j)(1). The examination may be performed by the tube manufacturer or the cylinder manufacturer. If the examination is performed by the tube manufacturer, the procedure must examine 100% of the finished side wall of the tubing and the tube manufacturer must certify the tube as meeting the ultrasonic test requirements. Additionally, the tube manufacturer's process must be subject to verification by an independent inspection agency approved under paragraph 8(a) of this exemption. If the cylinder manufacturer

performs the examination, the examination must be performed on each completed cylinder after heat treatment, under the supervision of an independent inspection agency approved for that purpose in accordance with paragraph 8(a). In either instance, the ultrasonic test equipment used must be calibrated to detect a one-inch notch equal to five percent in depth of the design minimum wall thickness, in accordance with ASTM Standards E-797 and E-213, using the straight and angle beams technique.

(2) Flattening test. For each lot of 200 cylinders or less, one cylinder taken at random must be flattened between knife edges which are wedge-shaped at a 60-degree angle and rounded to ½ inch radius; Longitudinal axis of the cylinder must be at approximately a 90 degree angle to the knife edges.

(3) Impact test. For each lot of 200 cylinders or less, three subsize Charpy V-notch specimens must be taken from the lower sidewall of one heat treated test cylinder at approximately evenly spaced (120 degree) intervals and tested at -50° C in accordance with ASTM E-23.

(4) Flawed cylinder cycle test. For each lot of 200 cylinders or less, one cylinder must be flawed and cycle tested as described in § 178.37(d)(2)(iv), of this exemption.

(5) Hardness test. A hardness measurement must be performed on the cylindrical section of each cylinder after heat treatment.

(k) Physical test. A physical test must be conducted to determine yield strength, tensile strength, elongation, and reduction of area of material as follows:

(1) * * *

(2) Specimens must conform to the following:

(i) Gauge length of 2 inches with width of not over 1½ inches.

(ii) * * *

(iii) * * *

(iv) * * *

(3) * * *

(l) Acceptable results of production tests.

(1) Impact test. The Charpy V-notch impact properties for the three specimens for each lot of cylinders must not be less than the values shown below at -50° C.

Size (mm)	Average value for acceptance 3 specimens	Minimum value one specimen only of the three	Lateral expansion inches	Fibrous fracture percent
10x4	12.0 ft.-lbs.	10.0 ft.-lbs.	0.012 inch	50%

(2) Flattening test. Flattening required without cracking to 8 times the wall thickness of the tested cylinder.

Continue flattening until cracking occurs. Maximum degree of flattening attained without cracking and knife clearance must be entered on the inspector's report.

(3) Flawed cylinder cycle test. The failure must originate in the cylinder sidewall and be by leakage before burst (LBB).

(4) Physical tests.

(i) Tensile strength must be between 135,000 psi and 155,000 psi.

(ii) Elongation must be at least 16 percent.

(5) Magnetic particle test. Any cylinder found to have a quench crack must be rejected and must not be requalified.

(6) Ultrasonic test. If this test is substituted for the magnetic particle test as permitted in § 178.37(j)(1)(i), any tubing or completed cylinder having a finished side wall with a discontinuity greater than the equivalent of five percent of wall thickness by one inch long notch must be rejected.

(7) Hardness test. The tensile strength equivalent of the hardness number obtained may not be more than 155,000 psi; (HRC 36). When the results of a hardness test exceed the maximum permitted, two retests may be made: however, the harness number obtained in each retest may not exceed the maximum permitted.

(m) Leakage test. All cylinders must be tested for leakage by air pressure after the bottom has been cleaned and free from all moisture. Pressure, approximately the same as but no less than the service pressure, must be applied to one side of the finished bottom over an area of at least 1/16 of the total area of the bottom but not less than 3/4 inch in diameter, including the closure, for at least one minute, during which time the other side of the bottom exposed to pressure must be covered with water, or other leak detecting fluid and closely examined for indications of leakage. Except as provided in § 178.37(n) of this exemption, a cylinder must be rejected if there is any leaking.

(n) Rejected cylinders from production testing.

(1) Reheat treatment of a production lot of cylinders rejected as a result of the impact test, flattening test, flawed cylinder cycle test, hardness test, or the physical test is authorized; subsequent thereto, acceptable cylinders must pass all prescribed tests.

(2) Cylinders rejected by the magnetic particle test (not including quenching cracks) are allowed to have surface scratches removed mechanically. If the area where the scratches were removed has a prescribed minimum wall thickness, that specific area must have a wall thickness measurement performed to insure compliance with the minimum wall thickness requirement; subsequent thereto, acceptable cylinders must pass all prescribed tests including the magnetic particle test.

8. SPECIAL PROVISIONS:

a. Before production of cylinders under this exemption may commence, the manufacturer and independent inspection agency must secure approvals in accordance with the provisions of § 107.803(c) and § 107.803(b), respectively.

b. After issuance of approvals in accordance with paragraph 8(a), for all cylinders produced under this exemption, the exterior finish must include a zinc or other coating which is compatible and assists in the protection of the exterior cylinder surface from corrosion.

c. In accordance with the provisions of § 173.22a(b), persons may use the packaging authorized by this exemption for the transportation of the hazardous materials specified in paragraph 6, provided all terms of this exemption are complied with.

d. A person who is not a holder of this exemption, but receives a package covered by this exemption, may reoffer it for transportation provided no modifications or changes are made to the package and all terms of this exemption are complied with.

e. A current copy of this exemption must be maintained at each facility where the package is offered for transportation.

f. Each cylinder must be requalified for use every five ears in accordance with § 180.205 as prescribed for DOT specification 3AA cylinders except that the minimum retest pressure must be 3/2 times the service pressure. Cylinders requalified after having been subjected to action of fire must be reported to the OHMEA prior to being placed in service.

g. Prior to the initial shipment of any specific design, a report of prototype test results specified in § 178.37(d)(2) of this exemption must be submitted to OHMEA. The cylinder manufacturer must retain the test reports required by this exemption for as long as these cylinders are authorized.

h. These cylinders must not be used for carriage of any gas that would cause hydrogen embrittlement of the steel.

i. Filling limits specified in § 173.302(a)(b) are not authorized. Under no circumstances are these cylinders to be filled to a pressure exceeding the marked service pressure at 70° F.

j. A current copy of this exemption, in its current status, must be maintained at the DOT approved manufacturing facility and must be made available to a DOT representative upon request.

k. Transportation of oxygen is only authorized by aircraft when in accordance with § 172.102(c)(2) Special Provision A52 and § 175.85(h)and (i).

9. MODES OF TRANSPORTATION AUTHORIZED: Motor vehicle, rail freight, cargo vessel, and cargo only aircraft. (See restriction in paragraph 8.k).

10. MODAL REQUIREMENTS: A current copy of this exemption must be carried aboard each cargo vessel, or cargo only aircraft used to transport packages covered by this exemption. The shipper must furnish a current copy of this exemption to the air carrier before or at the time the shipment is tendered.

11. COMPLIANCE: Failure by a person to comply with any of the following may result in suspension or revocation of this exemption and penalties prescribed by the Federal hazardous materials transportation law, 49 U.S.C. 5101 et seq:

- All terms and conditions prescribed in this exemption and the Hazardous Materials Regulations, Parts 171-180.
- Persons operating under the terms of this exemption must comply with the security plan requirement in Subpart I of Part 172 of the HMR, when applicable.
- Registration required by § 107.601 et seq., when applicable.

Each "Hazmat employee", as defined in § 171.8, who performs a function subject to this exemption must receive training on the requirements and conditions of this exemption in addition to the training required by §§ 172.700 through 172.704.

No person may use or apply this exemption, including display of its number, when the exemption has expired or is otherwise no longer in effect.

12. REPORTING REQUIREMENTS: The carrier is required to report any incident involving loss of packaging contents or packaging failure to the Associate Administrator for Hazardous Materials Safety (AAHMS) as soon as practicable. (Sections 171.15 and 171.16 apply to any activity undertaken under the authority of this exemption.) In addition, the holder(s) of this exemption must also inform the AAHMS, in writing, as soon as practicable of any incidents involving the package and shipments made under this exemption.

Issued in Washington, D.C.:

MAY 20 2004

Robert A. McGuire
for Associate Administrator for
Hazardous Materials Safety

(DATE)

Address all inquiries to: Associate Administrator for Hazardous Materials Safety, Research and Special Programs Administration, Department of Transportation, Washington, D.C. 20590. Attention: DHM-31.

Copies of this exemption may be obtained by accessing the Hazardous Materials Safety Homepage at http://hazmat.dot.gov/exemption Photo reproductions and legible reductions of this exemption are permitted. Any alteration of this exemption is prohibited.

PO: DH/sln